OAR Box 1214

Prepped by Ollie Stewart

Document Number:

4) V-A-1

Docket Number:

A-91-46

A-91-46
IV-A-1

[FRL-]

Fuels and Fuel Additives; Waiver Application

AGENCY: Environmental Protection Agency (EPA)

ACTION: Notice

SUMMARY: Under section 211(f)(4) of the Clean Air Act (Act), Ethyl Corporation (Ethyl) has requested a waiver to permit the sale of its gasoline additive, methylcyclopentadienyl manganese tricarbonyl (MMT), an octane enhancer, commercially labeled by Ethyl as HiTEC 3000. Section 211(f)(4) authorizes EPA to grant such a waiver if it determines that the applicant has established that its fuel or additive will not cause or contribute to the failure of vehicles to meet applicable emissions standards.

In support of its request, Ethyl conducted an extensive test program to determine the effect of MMT on the ability of vehicles to comply with current and future emission standards. It also considered the impact of MMT on nonregulated vehicle emissions, urban smog or ozone, refinery emissions, and crude oil use. Ethyl claimed that its test results established that MMT would not cause or contribute to exceedences of current or future emission standards. It also claimed that MMT use would result in other benefits consistent with Clean Air Act goals.

The Agency is today denying Ethyl's request for a waiver for HiTEC 3000 based on new data submitted to the Agency which indicate that factors other than those taken into account in Ethyl's test program may significantly and adversely influence the magnitude of the emissions increase caused by the addition of HiTEC 3000 to

unleaded gasoline. Hence, the Agency is unable to conclude that Ethyl has met its burden of establishing that HiTEC 3000 will not cause or contribute to the failure of a significant number of vehicles to fail emissions standards. Therefore, Ethyl's waiver request is denied.

ADDRESS: Copies of the information relative to this application are available for inspection in public docket A-91-46 and A-90-16 at the Air Docket (LE-131) of the EPA, Room M-1500, 401 M Street, S.W., Washington, D.C. 20460, (202) 260-7548, between the hours of 8:30 a.m. to noon and 1:30 p.m. to 3:30 p.m. weekdays. As provided in 40 CFR Part 2, a reasonable fee may be charged for copying services.

FOR FURTHER INFORMATION CONTACT: David J. Kortum, Environmental Engineer, or James W. Caldwell, Chief, Fuels Section, Field Operations and Support Division (EN-397F), U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460, (202) 382-2635.

SUPPLEMENTARY INFORMATION:

Decision of the Administrator

I. Introduction

On July 12, 1991, Ethyl submitted its application for a waiver for use of MMT in unleaded gasoline at a concentration of 1/32 gram per gallon manganese (gpg Mn).[1] MMT is a manganese-based octane enhancer that is currently used in leaded gasoline in the United States and in unleaded gasoline (at concentrations up to 1/16 gpg Mn) in Canada. As explained later in this decision, because MMT is less expensive than other available octane enhancers, EPA expects, and Ethyl acknowledges, that MMT would eventually be used in most gasoline sold in the United States if this waiver application is granted.

II. Statutory Framework

Ethyl is seeking this waiver because the sale of MMT for use in unleaded gasoline in the United States is currently prohibited by section 211(f) of the Clean Air Act. Section 211(f)(1) bans the sale of fuels and fuel additives (collectively referred to here as fuels) that are not "substantially similar" to those used to certify 1975 and later model year motor vehicles as complying with applicable emission standards. Under EPA's interpretive rule, MMT

---

[1] On August 1, 1991, a notice was published in the Federal Register (56 FR 36810) acknowledging receipt of the application and requesting comments on it. Comments that were received have been placed in public docket A-91-46.

is not considered substantially similar to certification fuel additives.[2]

Congress added section 211(f) to the Clean Air Act in 1977 to protect vehicle emission control devices from being damaged by fuels. As Congress was considering the Clean Air Act Amendments of 1977, concerns were raised that MMT, then used in unleaded gasoline, was impairing the performance of emissions control systems and increasing exhaust hydrocarbon emissions.[3] Although section 211(c) gives EPA authority to prohibit or control fuels found to harm emission control devices or public health and welfare, Congress acknowledged that the procedural safeguards required by that section did not permit EPA to act quickly enough to protect current catalysts.[4] Congress therefore decided to take a preventative approach, banning fuels not substantially similar to those used to determine compliance with emission standards. The effect of 211(f) was to ban the use of MMT in unleaded gasoline, effective September 15, 1978.

At the same time, Congress recognized that its ban could prevent the sale of cheaper or energy-optimizing fuels that did not harm emission controls.[5] In section 211(f)(4), it authorized the

---

[2] EPA's revised interpretation of "substantially similar" was published in the Federal Register on February 11, 1991 at 56 FR 5352. Under this rule, fuel additives must contain only carbon, hydrogen, and any or all of the following elements: oxygen, nitrogen, and/or sulfur.

[3] S. Rep. No. 127, 95th Cong., 1st Sess. 90 (1977).

[4] Id.

[5] Id. at 91.

Administrator of EPA to waive the prohibitions and limitations of section 211(f) "if the Administrator determines that the [waiver] applicant has established that such fuel or fuel additive ... will not cause or contribute to the failure of an emission control device or system (over the useful life of any vehicle in which such device or system is used) to achieve compliance by the vehicle with the emission standards to which it has been certified pursuant to section 206 of the Act."[6] If the Administrator does not act to grant or deny the waiver request within 180 days of receipt of the application (in this case, by January 8, 1992), the statute provides that the waiver request shall be treated as granted.

III. Method of Review

Section 211(f)(4) clearly places upon the waiver applicant the burden of establishing that its fuel will not cause or contribute to the failure of any vehicle to meet emission standards. Absent a sufficient showing, the Administrator may not make the required determination and may not grant the waiver. If interpreted literally, however, this burden of proof imposed by the Act would be virtually impossible for an applicant to meet, as it requires the proof of a negative proposition: that no vehicle will fail to meet emission standards to which it has been certified. Such a literal interpretation would require the testing of every vehicle.

---

[6] Section 206 of the Act sets forth the certification requirements with which vehicle manufacturers must comply in order to introduce into commerce new model year motor vehicles.

Standards for hydrocarbon, carbon monoxide, and oxides of nitrogen emissions from gasoline-powered motor vehicles have been established under section 202 of the Act.

Recognizing that Congress contemplated a workable waiver provision, EPA has previously indicated that reliable statistical sampling and fleet testing protocols may be used to demonstrate that a fuel under consideration would not cause or contribute to a significant failure to meet emission standards by vehicles in the national fleet.[7]

To determine whether a waiver applicant has established that the proposed fuel will not cause or contribute to vehicles failing emissions standards, EPA reviews all the material in the public docket, including the data submitted with the application, and analyzes the data to ascertain the fuel's emission effects. The analysis concentrates on four major areas of concern -- exhaust emissions, evaporative emissions, materials compatibility, and driveability -- and evaluates the data under statistical methods appropriate to the various types of emission effects. Emission data are analyzed according to the effects that a fuel is predicted to have on emissions over time. If the fuel is predicted to have only an instantaneous effect on emissions (that is, the emission effects of the fuel are immediate and remain constant throughout the life of the vehicle when operating on the waiver fuel), then "back-to-back" emission testing will suffice.[8]

---

[7] See Waiver Decision on Tertiary Butyl Alcohol ("TBA"), 44 FR 10530 (February 2, 1979).

[8] Back-to-back emission testing involves testing a vehicle on a base fuel (i.e., a gasoline which meets specifications for certification fuel or is representative of a typically available commercial gasoline), then testing that same vehicle on the fuel for which the waiver is requested. The difference in emission levels is attributed to the waiver fuel.

Unlike materials traditionally allowed in unleaded gasoline, metallics, such as MMT, produce non-gaseous combustion products, some of which are deposited in the parts of the vehicle which come in contact with the combustion products of the burned fuel. These areas of the vehicle include the combustion chamber, the catalyst, the oxygen sensor, and all parts of the exhaust system.[9] Since these materials build up over time,[10] it has been traditionally accepted that the emissions effects of such additives occur over time as miles are accumulated, and that the method of deposition suggests that the effects are permanent. If the fuel is predicted to have a long-term deteriorative effect, durability testing over the useful life of the vehicle,[11] in addition to back-to-back

---

[9] Automakers and catalyst manufacturers point out that, since catalysts are designed with a honeycomb structure in order to maximize contact between engine combustion gases and catalyst materials, if channels within the honeycomb become blocked, the catalyst is less able to break down the exhaust gases. Furthermore, although the mechanisms associated with manganese deposits have not been completely described, catalyst manufacturers suggest that the mere deposition of manganese (without blockage of channels) would hinder the catalytic activity of the catalyst. Ethyl, however, believes that the manganese deposition on the catalyst does not hinder its activity.

[10] Reply Comments of Ethyl Corporation in Support of the HiTEC 3000 Waiver Application, August 10, 1990, 28.

[11] The current "useful life" of a light-duty vehicle (LDV) (i.e., the amount of time or mileage accumulation through which the LDV must meet the standards to which it has been certified) is 50,000 miles or five years, whichever occurs first (section 202(d)). However, the Clean Air Act Amendments of 1990 extended the useful life of LDV's to 100,000 miles or ten years, beginning with 1994 model year vehicles. The amendments also tightened emissions standards for 40 percent of a vehicle manufacturer's LDV and light-duty truck (LDT) sales in model year 1994, 80 percent in model year 1995 and for all vehicles after model year 1995 (section 202(g)).

testing, is appropriate.[12] In the past, EPA has analyzed durability data using statistical tests to determine if the fuel additive will cause or contribute to a "significant" number of vehicles failing emissions standards.[13] Reasonable theoretical judgments as to the emission effects of the fuel may be utilized as an alternative to direct testing of vehicles. In most cases, the theory needs to be supported by confirmatory testing.[14] If the applicant has such a

---

[12] Durability testing over the useful life of the vehicle involves testing two identical sets of vehicles for 50,000 miles (in the case of current standards for passenger cars), one set using the base fuel and the other using the waiver fuel. Each vehicle is tested for emissions at 5,000 mile intervals. This is essentially the same testing pattern which is required for certification of a new motor vehicle under section 206 of the Act. As noted above,under the Clean Air Act Amendments of 1990, the useful life of passenger cars will be extended to 100,000 miles beginning with the 1994 model year when more stringent standards take effect (see sections 202(d) and (g)).

[13] The Agency has statistically analyzed exhaust emissions data to determine long-term durability effects of an additive only once previously: Ethyl's original 1978 application for MMT. The portion of the statistical tests that EPA used to determine if the additive would cause (or contribute) to emissions failures deems an additive not to cause such a failure for a particular vehicle model if its use would result in no more than 10 percent of vehicles of that model failing emissions standards. Before the additive was judged to have failed the test overall, more models must fail (as discussed above) than is consistent with the hypothesis, used for statistical purposes, that the population failure rate for models is 50% (for the 8 models tested with this application, at least 7 would have to fail). As discussed later in this section, EPA questions whether it would still be appropriate for the Agency to grant a waiver to an additive that would potentially cause such a large number of vehicles to fail emissions standards, in light of continuing and widespread pollution problems to which vehicles contribute. However, the Agency did not reach that issue in this decision since, as is indicated below, newly submitted data indicate that the design of the Ethyl test program may have insufficiently covered parameters which may have a significant adverse impact on the emissions effects of MMT.

[14] See Waiver Decision on Application of E.I. DuPont de Nemours and Company (DuPont), 48 FR 8124 (February 25, 1983).

theoretical basis, it may only need to conduct testing sufficient to demonstrate the validity of the theory. The theory and confirmatory testing may then form a basis from which the Administrator may exercise his judgment on whether the additive will cause or contribute to a failure of emission control devices or systems which result in vehicles failing to achieve compliance with emission standards.

In addition to emissions data, EPA also reviews data on fuel composition and specifications, both to fully characterize a proposed fuel, and to determine whether that fuel would cause or contribute to a failure of vehicles to comply with their emission standards. Such failure often can be predicted from characterization data. For example, volatility specifications of the fuel could demonstrate a tendency for high evaporative emissions. Similarly, data on materials compatibility could show potential failure of fuel systems, emission related parts, and emission control parts from use of the fuel. Such failures could result in greater emissions. Likewise, fuel characteristics that could cause significant driveability problems could result in tampering with emission controls and, thus, increased emissions.

An issue in this waiver decision is whether Ethyl must show that MMT will not cause or contribute to noncompliance with emission standards by vehicles certified to the 1994 model year emission standards, as well as vehicles certified to the current standards. Ethyl believes that the statute only requires it to establish that MMT will not cause or contribute to the failure of

vehicles to meet current emission standards. EPA disagrees.

Section 211(f)(4) provides that EPA may grant a waiver if the Agency determines that the waiver applicant establishes that its candidate fuel "will not cause or contribute" to a vehicle's failure to comply with "the emissions standards with respect to which [the vehicle] has been certified pursuant to section [206]." The section thus calls for EPA to make a prospective determination -- what will be the effect of the candidate fuel on vehicles in the future. Whether EPA should consider the effect on vehicles' ability to meet future emissions standards is not explicitly addressed. Clearly, consideration of future standards is not expressly prohibited.

There is no need to infer from the use of the past tense in the phase, "standards ... to which [a vehicle] has been certified" that only current standards may be considered. Section 203 of the Act requires each new model of motor vehicle or engine to be certified as complying with emissions standards before it can be sold. In section 211(f)(4), the phrase "has been certified" simply reflects that fact. Any vehicle affected by a commercial gasoline additive will be of a type that "has been certified" to emissions standards in effect when the model was new. For vehicles made in the future, these standards could be future standards.

It would make little sense to grant a waiver without regard to its effect on vehicles' ability to meet tighter standards that take effect in the near future. It also would be inconsistent with Congress's concern that fuels not cause or contribute to vehicles'

inability to comply. Conceivably, a fuel could have no effect on vehicles designed to meet current standards, but a significant effect on the technology automakers have strived to develop to meet tighter standards. EPA notes that section 211(f)(4) does not require the Agency to grant a waiver if the statutory waiver criterion is met. (See, for comparison, sections 211(k)(5)(B) and 211(m)(3).) The Agency thus has discretion in granting waivers, and for the reasons given above, EPA believes it reasonable to take into account the effect of a fuel on vehicles' ability to meet future emissions standards in exercising its discretion.

While it may not be feasible for a waiver applicant to consider the effect of its fuel on vehicles' ability to comply with standards due to take effect far in the future, that is not the case here. The "Tier I" tailpipe standards prescribed by section 202(g) begin to take effect in model year 1994, which begins in September 1993.[15] The technology that will be used to meet those standards is largely developed, and as explained later, test data submitted on MMT's emissions effect includes data from vehicles the design or technology of which are at least in part representative of vehicles being planned for the 1994 model year. EPA has previously considered the effects of an additive on vehicles' ability to meet more stringent future standards under circumstances similar to these, and believes it is appropriate to do so again

---

[15] 56 FR 25724-25790 (June 5, 1991).

here.[16]

This application also raises some important questions regarding the test programs the Agency has required to be performed and statistical criteria the Agency has used in the past to evaluate waiver applications. As noted above, the tests do permit a potentially large number of vehicles to exceed emissions standards.[17] In addition, the extent to which highly controlled vehicle testing simulates "real world" in-use[18] vehicle emissions changes is questionable. Further, the large amount of headroom[19] between test vehicles' certification emissions levels and the

---

[16] See 43 FR 41424 (September 18, 1978), In Re Application for MMT Waiver.

[17] The structure of the sign test used as the final step in most of the statistical tests is extremely conservative because it essentially places a very light burden on the applicant. It requires only that the applicant show that no more than half of the fleet will be caused to fail the standards by the additive. The practical implication of this arrangement of the test is that, with the small number of models usually included in the sample for such test programs, all or almost all of them must fail before the overall test is failed and the conclusion reached that the additive "causes or contributes" to the failure of a "significant portion" of the fleet to meet the standards to which they were certified.

[18] "In-use" refers to the emissions of vehicles actually being driven on public roads and highways and not part of any test program.

[19] "Headroom" here refers to the difference in emissions between the level of emissions seen in highly controlled testing of vehicles in a test program (such as with vehicle certification) and the emissions standard applicable to the vehicle. It is EPA's experience that vehicle manufacturers design this headroom into certification vehicles in order to account for the unknown effects of in-use operation. The manufacturers believe that such headroom is necessary in order to avoid expensive recalls of vehicles that fail standards in use. Despite this headroom, in calendar year 1991, 1.7 million cars were recalled for emissions exceedences.

applicable standard that has been seen in recent years[20] may effectively result in a much lower pass/fail standard than in the past, since it is easier to pass the previously used statistical tests when there is a large amount of headroom. As emissions standards become more stringent beginning in 1994 (See Appendix 2), the Agency would expect that the headroom between vehicle emissions and the standard is likely to decrease. This will result in more vehicles more easily failing standards.

In light of the Clean Air Amendments of 1990 and the likely widespread use of MMT, however, EPA questions whether its tests are still appropriate. The Clean Air Act Amendments of 1990 are a strong statement of the concern shared by Congress and the President that more needs to be done to ensure that people are not exposed to unhealthy levels of airborne pollution. Ozone, in particular, has been a difficult air pollution problem to solve. Despite the efforts states and industry had undertaken pursuant to the Clean Air Act of 1970 and the Amendments to the Act in 1977, in 1990 there were still 98 areas, containing approximately 135 million people, that violated the ambient ozone standard. In the 1990 Amendments to the Act, Congress prescribed increasingly stringent and costly control measures for inclusion in state SIP's. For example, depending on the severity of an area's ozone problem, it may be required to establish or tighten already established automobile inspection and maintenance programs; install automobile

---

[20] An analysis of EPA's certification data indicates that hydrocarbon certification data average 0.21 gpm.

refueling pumps with controls to capture refueling vapors; implement transportation control measures such as establishing carpooling lanes; or require the use of cleaner alternative fuels in fleet vehicles. Congress also called on automakers to significantly reduce new vehicle emissions and on oil refiners to reformulate gasoline so as to significantly reduce ozone-producing and toxic emissions from existing vehicles. EPA estimates the costs associated with the programs contained in the new amendments for ozone reduction in nonattainment areas to reach $11 billion per year by 2005.[21]

However, as explained in a later section, EPA cannot conclude that Ethyl has established that MMT will not cause or contribute to vehicles failing emissions standards under EPA's previously used statistical tests in light of additional data submitted to the Agency. Consequently, the Agency did not decide whether or how to change its statistical tests for determining whether a fuel will "cause or contribute" to vehicles failing emissions standards. EPA is continuing to evaluate the appropriateness of these tests.

IV. Ethyl's Application

This is Ethyl's fourth application for a waiver for MMT. Ethyl first submitted an application on March 17, 1978 for concentrations of MMT resulting in 1/16 and 1/32 gpg Mn in unleaded gasoline. That application was denied because the Agency found that the use of MMT would cause or contribute to the failure of

---

[21] "Ozone Nonattainment Analysis - Clean Air Act Amendments of 1990", E.H. Pechan Associates, prepared for USEPA, September, 1991.

vehicles to meet the hydrocarbon exhaust emissions standard (43 FR 41424, September 19, 1978).

Ethyl's second application was submitted on May 26, 1981 for concentrations of MMT resulting in 1/64 gpg Mn in unleaded gasoline. EPA denied the second request because Ethyl provided no test data to support its claim that MMT at that concentration would not cause or contribute to exceedences of the HC emission standard, and instead relied on a flawed mathematical argument extrapolating from HC emission data collected at higher concentrations (46 FR 58630, December 1, 1981).

Ethyl's third application was submitted on May 9, 1990 for concentrations of MMT resulting in 1/32 gpg Mn in unleaded gasoline. Ethyl withdrew its third application on November 1, 1990, before the deadline for the Administrator to make a determination on the application. Because no determination had been made at the time the applicant withdrew the application, EPA accepted the withdrawal and terminated the proceeding without taking action on it. Ethyl reapplied in July of 1991 after supplementing the data and analysis that had been contained in its third application. Essentially, the information related to the third (1990) application is pertinent to the application being considered today and all docket material submitted in consideration of the 1990 application has been incorporated, by reference, into the docket for the current (1991) application.

In support of its current application, Ethyl conducted the most extensive test program ever conducted by a waiver applicant.

It sought and received EPA's help in the design of a test program that was expected to provide the data needed to determine whether MMT passed EPA's previously used statistical criteria for granting waivers. Ethyl assembled a test fleet of 48 light-duty vehicles, composed of eight different model types that together represented a broad spectrum of then current (1988) technology vehicles. It utilized two laboratories to measure each vehicle's exhaust emissions of the regulated pollutants (HC, oxides of nitrogen (NOx) and carbon monoxide (CO)) at 5,000-mile intervals up to 75,000 miles in the case of most vehicles and up to 100,000 miles in the case of several.[22] It also tested the vehicles for evaporative HC, particulate and manganese emissions, materials compatibility, driveability and catalyst durability.

Ethyl analyzed the data collected using EPA's previously used statistical tests and additional tests developed by its consultants to further characterize the data. Its analysis indicated that, on average, MMT at the requested concentration would result in a 0.018 gpm increase in HC emissions and decreases in NOx and CO emissions. The analyses further indicated that, when EPA's previously used tests are applied, the increase in HC emissions would not cause or contribute to vehicles' failure to meet the current HC emission standard. The results of Ethyl's testing for materials

---

[22] The current "useful life" of a light-duty vehicle (LDV) is 50,000 miles or five years, whichever occurs first (section 202(d)). However, the Clean Air Act Amendments of 1990 extended the useful life of LDV's to 100,000 miles or ten years, beginning with 1994 model year vehicles. For the standards that begin to take effect in model year 1994, section 207(c) provides for intermediate in-use standards for several years.

compatibility, driveability and catalyst durability also indicated that MMT would have no significant adverse effects on vehicles' ability to meet current emission standards under average driving conditions. On that basis, Ethyl claimed that it had made its statutorily required showing.

Additionally, Ethyl submitted an analysis of its data which, according to Ethyl, indicates that MMT will not cause or contribute to the failure of vehicles to meet future standards. Ethyl Corporation engaged Systems Applications Inc. (SAI) to undertake an analysis to determine whether the additive would be likely to pose a problem for vehicles required to meet more stringent future standards and useful life definitions. The standards used in the analysis were those which were then being considered by Congress for inclusion in the Clean Air Act. The standards Congress eventually adopted are essentially the same.

The basic strategy of the analysis was to see if a subset of five of the eight models Ethyl tested in the larger program would pass the statistical tests previously used by EPA when compared to the proposed standards. The models selected were those passing the current standard for hydrocarbon. No adjustment was made to the test vehicles' emissions other than to remove the methane fraction of hydrocarbons for comparison against the proposed non-methane hydrocarbon (NMHC) standard. The three statistical tests used were all regression-based tests: 1) the Violation Mileage test, 2) the Maximum Percent Failing to Meet Standard test, and 3) the test

labelled by Ethyl the "Cause or Contribute" test.[23] Ethyl concluded that its analysis indicates that HiTEC 3000 will not cause or contribute to the failure of vehicles to meet future standards.[24]

While stating that "public health issues are not relevant to the legal standard for approval of waiver applications established by section 211(f)(4),"[25] Ethyl also assessed the potential effect of MMT use on public health and the nation's economy and energy security. In the area of public health, it examined whether MMT use would result in manganese emissions that could endanger public health. (While manganese is an essential nutrient, occupational studies have demonstrated that, at high doses, manganese can have severe adverse effects on the nervous, respiratory and reproductive systems. The health effects of manganese are discussed further in Section VI-C.) Based on the data Ethyl had collected on manganese exposure, Ethyl concluded that MMT use at the requested concentration would not perceptibly change environmental exposure to manganese and, in any event, would not present any danger to human health.

Ethyl also considered the effect of MMT use on emissions of other, unregulated vehicle emissions. Its testing indicated that vehicles run on MMT emitted less formaldehyde and benzene than

---

[23] For a description of these tests see Appendix 2A, Ethyl 1990 Waiver Application. For a description of Ethyl's analysis using these tests, see Appendix 11, Ethyl 1990 Waiver Application.

[24] Ethyl 1990 Waiver Application, 57.

[25] Ethyl waiver application (July 12, 1991) at 38.

vehicles operated on "clear" fuel. Ethyl hired Turner and Mason, refining industry consultants, to assess how the availability of MMT would likely change gasoline composition, yield and refinery emissions. The study by Turner and Mason concluded that MMT would allow a reduction in refining severity,[26] which in turn would reduce refinery emissions (NOx, CO, oxides of sulfur (SOx), particulates, and carbon dioxide), the use in gasoline of aromatics (which increase benzene emissions and are very reactive in forming urban smog) and benzene (a known carcinogen), as well as the demand for crude oil (by about 82,000 barrels per day).

V. Public Comments

EPA held a public hearing on Ethyl's application on September 12, 1991. It also provided an opportunity for the public to submit written comments.[27] Many comments were received from a wide variety of interests, including refiners, automakers, emission control manufacturers, manganese-related industries, federal health agencies, states, localities, environmental and public interest

---

[26] Refinery severity refers to the temperature and pressure at which certain parts of the refinery are operated. A "reformer", one of many refineries processing units, may be operated at higher temperatures and pressures to produce more high octane components such as benzene, xylene, and toluene, collectively referred to as "aromatics". Since MMT would supply a less expensive source of octane, the presumption is that the refinery would operate at a lower severity, thus using less fuel to operate and producing fewer emissions. Additionally, gasoline produced at a refinery operating at lower severity would presumably contain lower aromatics.

[27] As mentioned previously, the comments received in consideration of Ethyl's 1990 application have been included in the public record for the current 1991 application. This includes all docket materials in docket A-90-16, as well as all testimony at the June 22, 1990 hearing.

groups and private citizens. Taken together, the comments touched on every aspect of Ethyl's application. They are summarized below; more detailed descriptions of some of the comments and EPA's responses to them appear in later sections of this document.

A. Emission-related comments.

Five automakers (Ford Motor Company (Ford), General Motors Corporation (GM), Toyota Technical Center, U.S.A., Inc. (Toyota), Chrysler Motors Corporation (Chrysler), and Nissan Research and Development Corporation (Nissan)), the Motor Vehicle Manufacturers Association (MVMA), the Association of International Automobile Manufacturers, Inc. (AIAM), and the Manufacturers of Emission Controls Association (MECA) all recommended denial of Ethyl's request and expressed two major concerns with regard to the addition of MMT to unleaded gasoline. First, they noted that the use of MMT will cause an increase in HC emissions. Most indicated that the more stringent emissions standards which begin taking effect in model year 1994 will make any increase in HC emissions particularly troublesome. Further, they stated that newer technology vehicles will likely be equipped with catalysts which are nearer the engine (more "closely coupled"). Such close coupling results in higher catalyst temperatures which, for at least older model vehicles, studies indicate make the catalyst more prone to the deposition of manganese.[20] These commenters stated

---

[20] Benson, Jack D., "Manganese Fuel Additive (MMT) Can Cause Vehicle Problems," SAE Paper 770655, June 7, 1977.
Furey, Robert L., and Jack C. Summers, "How MMT Causes Plugging of Monolithic Converters," SAE Paper 780004, February 27-March 3, 1978.

that deposition of manganese compounds on the surface of the catalyst would impair the catalytic breakdown of emissions from the engine, thereby decreasing catalyst effectiveness. Additionally, they were concerned that MMT, even at the 1/32 gpg Mn concentration requested, would plug catalysts and thus reduce the surface area of the catalyst which could potentially act to break down emissions from the engine, especially in the case of vehicles operated under driving conditions which result in higher temperatures such as heavy load or high speed. Under such conditions, it was pointed out, the vehicle may be more prone to deposition of manganese.

Most of these commenters cited what they considered to be flaws in the Ethyl test program, especially the fact that Ethyl utilized a fuel to accumulate mileage on its test vehicles (Howell EEE) which, unlike fuels typically used by the driving public and for mileage accumulation when certifying vehicles, did not contain a detergent additive. Since detergents prevent the normal deposition of heavy hydrocarbon deposits in the intake system and combustion chamber of a vehicle that results from burning any gasoline, and since such deposits can increase HC emissions,[29] the automakers felt that these emissions increases may have masked any MMT-induced emissions increases.

Some pointed out that high temperature vehicle operation may increase the risk of manganese deposits and that Ethyl accumulated mileage on its vehicles using a driving regimen that may not be

---

[29] See for example, "Gasoline Additives Solve Injector Deposit Problems", SAE Technical Paper 861537, October 6-9, 1986.

conducive to the buildup of manganese deposits, since it did not include much driving that would result in high catalytic converter inlet temperatures. (As is discussed in Section IV-A of this decision, research suggests that high temperatures may result in higher rates of manganese deposition when MMT-containing gasoline is combusted in a vehicle.)

Several of these commenters also pointed out that Ethyl replaced the fuel injectors on its vehicles after the 50,000 mile point, which may have masked the effect of MMT. The automakers felt that since the fuel injectors had been changed at 50,000 miles, any negative impact on emissions caused by manganese fouling of the injectors would not have been seen by Ethyl.

Two automakers submitted new emissions data on vehicles operating on MMT. Ford submitted data on eight vehicles representing two model groups, four of which accumulated mileage using MMT-containing fuel and four of which were used as "controls" operating on "clear" fuel (fuel not containing MMT). Toyota submitted data on one vehicle which was operated on MMT-containing fuel for 30,000 miles and then, after replacing the catalytic converter and oxygen sensors, operated on clear fuel for 30,000 miles. General Motors submitted data on bench tests[10] of two truck engines. As described in more detail in Section VI-A, all of this data suggested that use of MMT may result in hydrocarbon increases greater than those reported by the Ethyl test program and/or

---

[10] Bench tests here refer to tests on engines which were conducted with the engine removed from the vehicle so as to facilitate the collection of data.

catalyst plugging.

The California Air Resources Board (CARB) also recommended denial of the waiver on emission-related grounds. California state law currently bans the use of MMT in unleaded gasoline, and an EPA decision to grant Ethyl's waiver request would not affect that ban. (The California ban, however, does not preclude the possibility that, if the waiver were granted, vehicles exposed to MMT could be used in California since vehicles would be able to utilize MMT-containing fuel in other states and then be driven in California. There is no evidence that any effect due to mileage accumulation using MMT-containing fuel would disappear if clear fuel were used subsequently. In fact, evidence that MMT deposits on catalysts suggests otherwise.)

According to CARB, the increased HC emissions attributable to MMT would make it difficult for vehicles operating on unleaded gasoline containing MMT to meet the new more stringent HC standards recently adopted for California vehicles.[31] CARB urged that testing be conducted to determine the effect of MMT on new technology vehicles designed to meet the more stringent HC standards, such as vehicles with electrically heated catalysts. It also expressed concern that manganese retained in the vehicle's catalyst could impair the performance of the vehicle's catalyst.

Environment Canada, a ministry of the Canadian government,

---

[31] The new California standards are introduced in several stages beginning in 1994, each stage of which establishes a more stringent control over non-methane organic gas (NMOG) which consists of HC and oxygenated hydrocarbons.

commented on Canada's experience using MMT in unleaded gasoline. (As mentioned previously, MMT is allowed in unleaded gasoline in Canada at twice the level asked for by Ethyl in this current waiver proceeding.) Environment Canada reported that it had little data on MMT effects on Canadian vehicles, but that it appeared that only a relatively small number of catalysts installed on Canadian vehicles had been adversely affected by plugging. It indicated, however, that differences between the Canadian and United States vehicle emission control programs made it less likely that any catalyst plugging would be discerned in Canada than might be the case in the United States.

Ethyl submitted responses to the comments summarized here. It noted that the test cycle which it used was the federal certification mileage accumulation cycle utilized to certify vehicles as meeting standards. Ethyl also criticized the test programs which were used by the automakers to collect data on the emissions-related effects of MMT use. Ethyl pointed out that the programs had little similarity to procedures utilized to certify vehicles as meeting standards. Ethyl stated that, in any event, statistical analyses of its data demonstrated that MMT at the requested concentration would not cause or contribute to failure by vehicles to meet current or future emissions standards. It also submitted, in its comments, additional data on catalysts from Ethyl's test fleet which, according to Ethyl, indicated that catalyst degradation would not occur as a result of MMT use.

In response to the automakers comments regarding Ethyl's

replacement of all fuel injectors after 50,000 miles, Ethyl stated that the fuel injectors were changed precisely to determine if use of its test fuel, Howell EEE, resulted in injector fouling since it did not contain a detergent additive. Ethyl indicated that emissions data collected on the vehicles before and after the injector replacements showed no significant emissions changes.

Ethyl also pointed out that, in the area of regulated emissions, once it has presented a prima facie case in support of its application, those opposing the application must present "competent" evidence sufficient to create an issue of fact to be determined by the fact finder.[32] Further, Ethyl stated that the Agency's decision must turn upon what the preponderance of the competent evidence in the record shows. (A more in-depth description of these issues is presented in Section VI-A of this decision.)

In response to comments that Ethyl did not use a detergent in its test fuel, Ethyl stated that the purpose of using a mileage accumulation test fuel without a detergent was to provide a worst-case scenario for deposit formation and, thus, address the concerns of the auto industry that MMT causes engine deposits which result in emissions increases. (The purpose of detergent additives is to prevent deposit formation.) Also in response to these comments, Ethyl operated six Buicks from its 48-vehicle fleet an additional 15,000 miles (after the original 75,000 miles) with commercial gasoline with MMT (for the MMT vehicles) and without MMT (for the

---

[32] Docket A-91-46, Item No. IV-E-5, Attachments.

clear fuel vehicles). Emissions tests every 5,000 miles indicated no significant change in emissions patterns from the original 75,000 miles of operation.

In regard to the Canadian experience with MMT, Ethyl pointed out that Canadian oil companies (including government-owned Petro Canada) that have used MMT in unleaded gasoline in the past are unaware of any catalyst problems experienced by customers using gasoline with MMT.

B. Other Comments

Commenters addressed other issues raised by Ethyl's application. Many dealt with the potential effect of MMT on public health. Commenters that supported the application generally pointed to Ethyl's analyses indicating that MMT use would result in an overall reduction of vehicle and refinery emissions. Several stated that MMT use would result in more flexibility for refiners in enhancing gasoline octane quality. Others, however, were troubled by the prospect of allowing MMT on the market before more was known about the health consequences of the manganese emissions that MMT would cause.

The National Institute of Environmental Health Sciences (NIEHS), the Environmental Defense Fund, CARB, and the American Psychological Association, among others, noted that little is known about low-level chronic exposure to airborne manganese. These commenters generally recommended that the Administrator exercise his discretion to deny the waiver request until the completion of studies sufficient to determine a "safe level" of exposure to

ambient manganese. (This issue is discussed further in Section VI-B of this decision.)

Chemetals, Inc., a manufacturer of manganese alloys, submitted comments stating that manganese is an essential human nutrient and that exposure levels expected to result from MMT use are far below any known toxic levels. Chemetals also strongly indicated its support of the Ethyl application.

In response to these comments, Ethyl pointed out that available data reveal no adverse health effects of exposure to manganese emissions at the levels expected to occur as a result of MMT use in unleaded gasoline. Ethyl also stated that monitoring and modeling data on exposure to manganese which it had submitted demonstrate that no significant difference in exposure would occur as a result of MMT use. It argued that having made a prima facie case that MMT would not harm public health, the burden shifted to those commenters who thought otherwise to substantiate their claims.

Comments from refineries and refinery trade associations were supportive of Ethyl's application. They concurred in Ethyl's assessment of the economic benefits and reduced refinery and vehicle emissions that would accrue from the replacement of octane obtained through higher-severity refining with octane obtained from MMT. Several emphasized that MMT would be especially helpful to small refiners since octane enhancement from MMT requires less capital investment than other means of increasing octane. Many refiners also pointed out that refinery operations at lower

severity would result in decreased aromatic and benzene emissions from vehicles and increased yield for each barrel of crude oil refined.

VI. Analysis

As indicated in the earlier section describing EPA's method of review, the Agency considers the effect of a fuel on compliance with vehicle emission standards in deciding whether to grant a waiver for the fuel. New data submitted to the Agency indicate that factors other than those taken into account in Ethyl's test program may significantly and adversely influence the emissions caused by the addition of HiTEC 3000 to unleaded gasoline. Hence, the Agency is unable to conclude that Ethyl has established that HiTEC 3000 will not cause or contribute to the failure of a significant number of vehicles to fail emissions standards.

As noted earlier, Ethyl and the commenters also raised issues about the effects of MMT on public health, refineries and crude oil demand. Moreover, since it is expected that, if allowed, the additive would be used very widely in gasoline, the Agency is concerned about the potential for MMT to increase the overall atmospheric loading of HC emissions, given the widespread serious ozone nonattainment problems. Because Ethyl has not met its primary statutory burden, the Agency chose not to base its decision to deny the waiver request on these issues. While EPA believes that the discretionary nature of its waiver authority permits the Agency to consider such issues in making waiver decisions, because the decision is being denied based on increases in HC emissions that cause or contribute to the vehicles failing emissions standards, these other issues need not be resolved. Nevertheless, EPA considers it worthwhile to address these other issues.

Decisions on future waiver applications might turn on such issues, and waiver applicants might benefit from the Agency's consideration of the issues here. These issues are thus addressed in the last subsection of this section.

A. Exhaust Emissions:

Ethyl's test program, as noted earlier, was designed and conducted to provide the data necessary to perform the statistical analyses that EPA has previously used to determine whether a waiver applicant has made the statutorily required showing. (These statistical tests, developed in the late 1970's by the Agency, are applicable only to additives which may produce a long-term durability effect on emissions and not an instantaneous effect and, in fact, have only been used previously to evaluate other applications by Ethyl to use MMT.) Assuming the data collected by the Ethyl program are accurate (and the Agency has no reason to believe they are not), EPA agrees with Ethyl that under the conditions simulated by Ethyl's test program, MMT at the requested concentration meets the statistical criteria EPA used in assessing the 1978 Ethyl application to establish that a fuel will not cause or contribute to a failure of a significant number of vehicles to meet current emission standards.

Ethyl's examination of MMT's effect on vehicles' ability to meet future standards for HC, is less convincing, but nevertheless indicates that MMT passes the determinative "cause or contribute" portion of EPA's previously used statistical tests. The approach Ethyl took to its examination -- a statistical analysis based on

data from 1988 vehicles -- has two potential problems. First, it assumes that 1) the emission control systems that manufacturers design and use to meet the new standards will be similar in technology to those used on the models Ethyl selected for testing, and 2) the response of these future systems to MMT is thus appropriately modeled by looking at the test vehicles. Ethyl did not evaluate the extent to which its test fleet was representative of vehicles designed to meet the 1994 model year standards. It did, however, make an effort to include in its test fleet vehicle models that were equipped or designed in what was thought to be representative of 1994 model year vehicles. Among the forward-looking technologies and designs found in Ethyl test cars were close-coupled catalysts and multiport fuel injection. While EPA is concerned that Ethyl's fleet was not fully representative of 1994 model year vehicles, the Agency appreciates the difficulty of obtaining test vehicles representative of future technology vehicles. Since Ethyl's fleet did contain vehicles that to some extent were representative of 1994 vehicles and the newer technology test vehicles did not show emission problems significantly different from older technology vehicles, EPA believes that the technological problems with Ethyl's future standards case are not significant enough to deny the waiver request on that basis.

Ethyl's case also presents statistical problems. The set of models selected by Ethyl for this analysis is statistically troubling for two reasons. First the set represents only the

"cleanest" portion of the fleet--a fleet that has substantial variability in emissions performance. It is not surprising that the lower tail of such a distribution would have very low emissions with or without MMT. The behavior of these vehicles reveals little about the entire distribution and its variability--information that is important to a robust conclusion regarding whether future vehicles will be able to meet the new and tougher standards when operating on MMT.

The second concern about the sample for this analysis is its small size. The sign test, which is the final step in each of the three tests used, requires that at least five models be included in the analysis before it becomes possible for the additive to "fail" any of the three tests. Even with five models, the additive only fails the overall test if all five models fail individually. In most of the comparisons that are made in the course of the analysis, some models drop out for various reasons and leave us looking at samples of four or fewer. Even if each of the four models in such a comparison were to fail the test (which happened in one case), the result would be inability to detect a difference at the 95% confidence level. In short as a result of the data limitations in Ethyl's analysis, it would have been impossible to fail four of the five tests. However, Ethyl's data is sufficient to apply EPA's previously used "cause or contribute" portion of the statistical tests. Application of that portion of the tests to the Ethyl data indicate that MMT would not cause or contribute to

vehicles failing the 1994 model year standard. At the same time, however, EPA is troubled about some aspects of the statistical tests (as explained above).

In any event, in regard to both current and future standards, the Agency has reason to believe that for conditions other than those used by Ethyl in its test program, the Ethyl test data may significantly understate the effect of MMT on HC emissions.

Ethyl employed two independent laboratories[33] to test its fleet of 48 model year 1988, light-duty vehicles (i.e. passenger cars), including three pairs of vehicles in each of eight model groups representing a broad spectrum (over 50 percent) of the national 1988 car fleet. After all of the vehicles had accumulated 1000 miles on a clear (i.e., no MMT added) test fuel referred to as "Howell EEE"[34], one vehicle from each pair was operated on the same clear fuel (the control vehicle) and the other vehicle from each pair was switched to a test fuel composed of the clear fuel to which HiTEC 3000 was added at a level of 1/32 gpg Mn (the MMT vehicle).

Each of the vehicles was tested for HC, CO and NOx exhaust emissions at 1000 miles to establish matched vehicle pairs and

---

[33] EPA and Ethyl's contract laboratories performed correlation tests (i.e., tests to measure the variability of emissions results between laboratories) and found the correlation to be good.

[34] Howell EEE is a high-quality gasoline with very tight specification of chemical and physical properties. Ethyl stated that it used Howell EEE in order to minimize base fuel variations over the life of the test program so that MMT-induced changes could be better isolated.

then, after switching half the vehicles to MMT-containing fuel, at each 5000-mile interval to 75,000 miles in the case of most vehicle pairs and to 100,000 miles in the case of several. The actual emissions testing at each of the mileage increments was performed using clear fuel for both the control vehicles and the MMT vehicles. This was done so that the effect of accumulating mileage with MMT could be isolated, since past research indicates (and Ethyl agrees) that the emissions effects of MMT results from manganese accumulation over many miles of use, not from the instantaneous effect of adding MMT to the fuel. To accumulate mileage, Ethyl utilized the "Alternative Mileage Accumulation Cycle" (AMA) which is a standard procedure utilized to accumulate mileage for certification purposes.[35]

Ethyl subjected its test data to the statistical analyses used by EPA in its past consideration of a request by Ethyl to use MMT and to further analyses developed by an independent contractor. Based on these analyses, one Ethyl contractor reported the following results: MMT at the requested concentration had a

---

[35] A driving cycle is a description of how to drive a vehicle to accumulate mileage including such things as a what percentage of driving should be done at what speed and what the overall average speed should be. The AMA cycle is described in EPA Mobile Source Advisory Circular 37-A, (See Docket A-91-46) and is essentially prescribed for use by manufacturers to accumulate mileage for certification of vehicles (See 40 CFR 86.092-26). A driving cycle is used so that test vehicles accumulate mileage in a manner that is supposedly representative of in-use vehicles. The emissions of a test vehicle that has accumulated mileage according to a driving cycle representative of in-use vehicles are more likely to be representative of in-use vehicles' emissions. There are actually three alternative cycles associated with the AMA; however, the average speeds of the three alternatives are very similar ranging from 29.9 mph to 30.72 mph.

beneficial impact on NOx emissions, reducing them on average by 0.07 gpm for the first 50,000 miles and 0.11 gpm averaged over 75,000 miles. It also had a beneficial impact on CO emissions, reducing them on average by 0.09 gpm for the first 50,000 miles and 0.22 gpm averaged over 75,000 miles. Only in the case of HC emissions did Ethyl's analysis indicate that MMT had any adverse effect: HC emissions were on average 0.018 gpm greater for the MMT vehicles both for the first 50,000 miles and for 75,000 miles.[36]

Ethyl also submitted data on the catalyst efficiency of the vehicles which it tested. Ethyl performed back-pressure tests[37] on all its vehicle fleet except one model group after accumulation of 75,000 miles. Back-pressure tests were also performed on a pair of Ford Crown Victorias, one operated on MMT-fuel and one on clear fuel, at speeds higher than those used in Ethyl's 48-vehicle test program.[38] The results of these tests indicate that back-pressure was not significantly different in the MMT vehicles when compared to the clear fuel vehicles. Ethyl also operated two 5.7 liter

---

[36] Ethyl 1990 Waiver Application, Appendix 2A, pp. D-25 through D-27. (Based on integrated emissions analysis of data set ETHYL4S2.)

[37] Back pressure tests are used to determine if significant plugging has occurred in a vehicle's catalyst. The total pressure ahead of the catalyst is back pressure. This pressure is a measure of constriction in flow through the exhaust system caused by flow of the exhaust through the emissions control system and the noise-reducing components of the vehicle. If plugging has occurred in a vehicle, the total pressure ahead of its catalyst, the back pressure, should be greater than expected (e.g., greater than a matching control vehicle).

[38] In this program the maximum speed was 65 mph for the first 25,000 miles and 80 mph for an additional 10,000 miles.

Corvettes at extremely high speeds (100 mph) for 25,000 miles, one using MMT fuel and one using clear fuel. Although similar in magnitude, the back pressure for the MMT vehicle was slightly higher than that for the clear vehicle. Ethyl also presented catalyst efficiency[39] data based on engine-out emissions of its fleet and based on "slave engine" testing[40] for half of its fleet. Results of the slave engine testing indicated no statistically significant difference between the catalyst efficiencies for the MMT vehicle components when compared with the clear vehicle components. Finally, four Chevrolet Corsicas were operated to 100,000 miles, two utilizing MMT fuel and two with clear fuel. The purpose of this testing was to investigate the MMT's effect on the catalyst for a longer mileage interval than the 75,000 miles over which most of Ethyl's fleet was driven. However, these Corsicas were not driven at speeds different from the vehicles in Ethyl's 48-vehicle program. Catalyst efficiencies of the MMT vehicles were not significantly different when compared to the clear fuel vehicles.

As mentioned previously, Ford presented original test data

---

[39] Catalyst efficiency is a measure of what fraction of the emissions entering the catalyst are actually removed (or catalyzed) by the catalyst.

[40] "Slave engine testing" is the testing of vehicle components on a single engine which is not in a vehicle. In this case, catalyst efficiencies between control and MMT vehicles were investigated using exhaust gases from this single engine which were routed through the removed catalysts. This would likely result in a more accurate analysis of catalyst efficiency, since one possible confounding factor, vehicle to vehicle variability, would be eliminated.

which Ford said supported its contention that actual in-use MMT-induced HC emissions increases are potentially far greater than those reported by Ethyl.[41] Ford conducted testing on a more limited scale utilizing eight vehicles, representing two model groups, run for 105,000 miles. Ford chose two model groups which are representative of its newest technology vehicles. One (the Explorer) represented a technology that Ford believed may be especially prone to exhibit a buildup of manganese, due to significantly higher operating temperatures and loads than those of passenger cars. The other model group, the Escorts, had close coupled catalysts, a design which is being incorporated into many new vehicles in order to meet tighter emissions standards. Like Ethyl, Ford used both vehicles run on clear fuel and vehicles run on fuel containing 1/32 gpg MMT. However, Ford's test program differed from Ethyl's program in several ways. When accumulating mileage, Ford utilized a commercial gasoline which contained all of the additives (detergents, etc.) typically found in such fuels. As mentioned previously, Ethyl utilized a very high quality test fuel with tight specifications and no additives. (Although used for actual emissions testing purposes, Ethyl's fuel would not be allowed for mileage accumulation when certifying vehicles since it is not representative of in-use fuel.) When accumulating mileage,

---

[41] EPA's emissions testing lab and Ford's lab routinely undergo correlation testing and the data indicate that correlation is good between the labs. (See memorandum, with attached data, from Martin E. Reineman, EPA Manager of Correlation and Engineering Services, Office of Mobile Sources, January 3, 1992, Docket A-91-46.)

Ford utilized what it called its "durability cycle" which it had previously developed. Compared to the AMA cycle used by Ethyl, Ford's driving cycle has a higher average speed (54 miles per hour (mph) versus 30 mph), and a higher percentage of high speed driving.[42] (As previously mentioned, Ethyl utilized the AMA cycle used for certification purposes.) Additionally, in the Ford program, vehicles were tested for emissions at five mileage intervals (5,000, 20,000, 55,000, 85,000[43] and 105,000 miles) and six emissions tests were done at each testing interval. Ethyl, by comparison, conducted testing every 5,000 miles to 75,000 miles (15 intervals) and utilized two emissions tests at each interval.[44] Ford's MMT vehicles showed HC emissions 0.12 gpm higher, on average, than the control vehicles (compared with 0.018 gpm seen in the Ethyl program).

Ethyl stated that the Ford results generally reflect the emissions performance of a single test vehicle and that the results

---

[42] Ford indicated that drivers who accumulated mileage in its test program were asked to follow posted speed limits. Ford indicated that the cycle consisted of 5% city driving (25 to 45 mph), 5% gravel or off road driving (25 to 45 mph), 20% rural driving (45 to 55 mph), and 70% highway driving (65 mph). Posted speed limits are shown in parentheses. By way of comparison, the AMA cycle consists of 16.1% of driving at 30 mph, 22.6 at 35 mph, 20.9 at 40 mph, 6.4 at 45 mph, 17% at variable speed and one of the three following options: 16.7% at 50 mph or 16.5% at 55 mph or 8.6% and 7.9% at 55 mph and 70 mph, respectively.

[43] In fact, only two of the four Escorts were tested at 85,000 miles.

[44] Although Ethyl conducted additional emissions tests at some mileage intervals when the initial two tests showed high variation, these additional tests were not used in Ethyl's analysis of its data.

are not credible. EPA evaluated the Ford data and has concluded that the Ford HC test data represent a very small set of model groups, only two, that were not selected through a statistical sampling process. Thus, very little can be said in a purely statistical way about the implications that the sample results have for the performance of the vehicle fleet as a whole. The Ford data have, however, been examined on a model-by-model basis to see what they tell us about the likely behavior of vehicles from each of the two model groups.

The Ford Escort data failed three of the five tests performed on them.[45] Data from the Explorer model failed all five tests. Thus the picture that emerges from examining the HC data for these models is one of definite increases associated with MMT in both cases. In one of the two models the increase was not sufficient to cause a failure of the current HC standard by the "cause or contribute" test and one other test. In the other model, the Explorers, the increase brings about an unequivocal failure of the current HC emissions standard.

Ford also exchanged the catalysts and oxygen sensors between each pair of vehicles after 100,000 miles of operation and tested for emissions effects. Generally, for HC emissions, the MMT vehicles performed better with components from the control vehicles

---

[45] Tests performed on both model groups were: 1) deterioration factors test, 2) violation mileage test, 3) maximum percentage exceeding the standard test, and 4) "cause or contribute" test. A description of this analysis can be found in a memo to Docket A-91-46 from John Holley, EPA, dated January 7, 1992.

and the control vehicles' performance degraded when run with components from the MMT vehicles. (A graphical summary of the results of this "component interchange" data can be seen in Appendix 1.) Ford concluded that the data clearly show that MMT impairs to a significant degree the performance of emission control devices.

Toyota also submitted data on a single vehicle which was operated for 30,000 miles on MMT-containing fuel after which the oxygen sensor and catalyst were replaced with new components and then driven on fuel not containing MMT for 30,000 miles. Toyota also used a driving cycle with an average speed (41.7 mph) higher than that used by Ethyl for mileage accumulation and used fuel with what Toyota believed was a relatively high trace level of lead than that usually found in unleaded gasoline (0.0045 gpg lead) and oil with a relatively high phosphorus level (0.13 weight percent). Toyota referred to this test procedure as the "Toyota 9-Laps" and presented evidence which it said suggested that the catalyst degradation seen by vehicles using the Toyota 9-Lap test was very similar to in-use catalysts tested by Toyota. Hence, Toyota suggested, these "adjustments" made in creating the Toyota 9-Lap make the testing of a vehicle more consistent with what would happen in actual in-use driving. Toyota's data indicated an HC level after the first 30,000 miles of vehicle use (on MMT fuel) about 0.1 gpm higher than the same vehicle after the vehicle was driven for a second 30,000 mile interval with a new catalyst and oxygen sensor. Toyota also submitted data indicating that the

efficiency at which the catalyst was operating for the MMT-exposed components was less than that for the non-MMT exposed components.

Ethyl criticized both the Ford data and the Toyota data. Ethyl stated that the Ford "fleet" is not representative of the national fleet in that it contains only two model groups and that half of the vehicles (the Explorers) were "prototype vehicles" unrepresentative of any existing production vehicles. EPA agrees with Ethyl that the Ford test vehicles are not representative of the entire U.S. fleet. As mentioned earlier, the fact that Ford's fleet is not representative is one of the reasons that Ford's data is insufficient to determine, using EPA's past statistical tests, whether MMT will cause or contribute to significant emissions noncompliance. At the same time, the Escort and Explorer represent a significant portion of the vehicle fleet, about four percent of vehicle sales for 1991 in the U.S.[46] More importantly, Ford's data is sufficient to indicate that MMT may affect vehicles more adversely under operating conditions different from those Ethyl used in its test program. The concern that Ford's data raises is not so much that particular models like the Escorts and the Explorers are more sensitive to MMT exposure than others, but that differences in driving cycle or other operating conditions may lead to differences in MMT's emissions effect. If operating conditions are key to MMT's effect, then many, or even most, models may be more seriously affected by MMT than Ethyl's data indicate under certain conditions. As a result, EPA believes Ford's data may be

---

[46] Automotive News, December 9, 1991.

instructive despite the fact that Ford tested only two models.

Ethyl was also concerned that the Explorers which Ford used were "prototypes" unrepresentative of existing production vehicles. Ford has stated that the Explorers tested are different from production vehicles only in their engine design and air pump, which are representative of 1993 model year production engines and air pumps. Moreover, none of the Explorers' emission control related equipment (i.e., catalyst and oxygen sensor) are different from current model vehicles. Based on its knowledge of vehicle design and development, the Agency believes that these vehicles are substantially similar to vehicles which are currently used or will be used in the future. For the reasons given earlier, EPA believes that testing of such prototype vehicles is appropriate because MMT's effect on vehicles' ability to meet the 1994 model year standards is relevant to whether MMT should be granted a waiver.

Ethyl also criticized Ford's component interchange data pointing out that, for at least some of the Ford component interchange data, when the HC emissions increased after putting an MMT-exposed catalyst in a clear vehicle, CO and NOx emissions did not likewise increase. Ethyl concluded that if "the additive had truly impaired the catalyst, one would expect to see this impairment reflected for all emissions, not just HC emissions."[47] EPA does not agree. In order to draw this conclusion, one would have to assume that the chemical and physical processes whereby each exhaust species is catalyzed are identical. This is not the

---

[47] Ethyl Comments, November 26, 1991, 21.

case. The catalyst component material which breaks down HC and CO is different than that which breaks down NOx. Furthermore, the physical and chemical processes involved in catalysis of CO and HC, such as surface adsorption, are different.[48] Additionally, the complex interactions between these exhaust species, the catalyst and manganese are not understood. Therefore, it is not possible to conclude that the presence of manganese on the catalyst should effect all species in the same manner. Therefore, the Agency believes that the mere fact that different emissions were affected differently by the apparent catalyst degradation seen by Ford does not, in itself, impugn the Ford data.

Ethyl also stated that vehicle maintenance logs provided by Ford demonstrated inconsistent treatment of its test vehicles. Ethyl indicated that Ford replaced ignition system components and spark plugs apparently using different types of components in different vehicles of the same model type. Concerning these issues, Ford noted that, during the course of the test program, spark plugs slightly different from the initial components were used as replacement parts for some vehicles. Ford stated that the plugs were of the same type and heat range as the initial plugs. The Agency believes that this type of slight variation in plug design would likely not materially effect emissions of the vehicle since the plug was the appropriate application and heat range. As

---

[48]Heterogeneous Catalysis: Principle & Applications 2nd ed., G.C. Bond, Clarendon Press, Oxford, 1987.
Heterogeneous Catalysis in Practice, Charles Satterfield, McGraw-Hill, New York, 1980.

to the ignition system component changes, Ford has stated that these components were materially identical, were of a design which had previously proven their durability and reliability and which would not account for any emission or emission deterioration differences between the vehicles. Hence, the Agency agrees that the change in ignition components that took place would not have affected the emissions differences between the vehicles because the components were, as stated by Ford, materially identical.

Ethyl also stated that Ford's vehicles experienced electronic engine control software problems and that vehicle maintenance logs provided by Ford demonstrated inconsistent treatment of its test vehicles. The software problems to which Ethyl refers are concerned with occurrences in Ford's maintenance logs which indicate that the "check engine light"[49] was illuminated. In its reply comments, Ford indicated that engineering evaluations of the vehicles were conducted after any check light illumination and that these evaluations did not indicate emissions system malfunctions, but, rather, that the sensing logic or methodologies associated with these devices were shown to be more sensitive than necessary. The Agency believes that, lacking any additional information regarding the emissions-related[50] significance of illumination of

---

[49] These diagnostic lights indicate to the driver (by illumination) that there may be a problem associated with a vehicle component. "Software" or computer directions which are associated with this feature "tell" the light when to illuminate as a result of electronic signals which emanate from various vehicle components.

[50] The Agency has defined emissions-related maintenance at 40 CFR 86.090-25.

these lights, engineering evaluations by Ford that the illumination were due to an overly sensitive logic design are sufficient to reassure the Agency that the illumination of these devices did not indicate emissions problems which should be taken into consideration.

Ethyl also noted that emissions tests were not always conducted by Ford before and after maintenance of its vehicles. Ford has supplied data that indicate that it did conduct emissions tests prior to and after emissions-related maintenance. It would be highly unlikely that non-emissions-related maintenance would have any effect on emissions performance. In fact, the regulations for certification do not require emissions testing before and after all unscheduled maintenance. Therefore, the Agency believes that testing before and after emissions-related maintenance is sufficient to assure that the breakdown of components within the vehicle did not drive the emissions changes seen by Ford.

Ethyl also pointed out that a "prep" cycle[51] was not conducted by Ford prior to emissions testing. Ford has replied that a prep cycle was conducted just prior to emissions testing of the first of several repeated tests but not before each subsequent test of a series of tests at each mileage interval. The Agency agrees with Ford that an additional prep cycle prior to each repeated test at a single mileage interval would not have significantly altered the

---

[51] A "prep" cycle is the driving of a vehicle for a short distance prior to the actual emissions test to ensure that erratic driving or unusual conditions (e.g., extreme heat or cold) just prior to testing, does not have an undue influence on the emissions test, itself.

results of the emissions tests. In the case of subsequent tests after the initial emissions test (which was itself proceeded by a prep cycle), driving associated with the previous emissions test would ensure that no erratic circumstances had been encountered prior to testing the vehicle. Furthermore, since both clear and MMT vehicles were treated similarly, any difference in emissions between the two would likely not be due to lack of a prep cycle.[52]

Ethyl also argued that the driving cycle used by Ford was not the cycle used for certification testing and, in any event, was not representative of actual in-use driving. The fact that Ford used other than the certification durability cycle is not, by itself, a problem with Ford's test program. The purpose of the certification durability cycle is to represent in-use driving for the purpose of determining whether a production prototype vehicle will meet emissions standards in-use. As a matter of practicality, the Agency has required the use of a specified "average" cycle for mileage accumulation in the certification of vehicles. However, the Agency believes that driving habits, like any human activity, vary over a range. Hence, it is reasonable, when evidence is presented suggesting that a driving cycle outside that used for certification may result in very different effects from use of an additive, that the Agency consider the repercussions of such effects. Furthermore, some automakers, believe that vehicles are subjected to more severe conditions in-use than the certification

---

[52] See memorandum from Martin E. Reineman, EPA Manager of Correlation and Engineering Services, Office of Mobile Sources, January 3, 1992, Docket A-91-46.

cycle represents. Since automakers whose vehicles do not comply with standards in-use face recall of their noncomplying vehicles, they have a strong incentive to realistically appraise in-use conditions for their effect on vehicle emissions compliance and to test their cars accordingly. Thus, Ford's use of other than the certification cycle is not necessarily inappropriate.

EPA agrees that the Ford test program used a driving cycle that was not representative of "average" in-use driving. Indeed, the Agency doubts that the Ford cycle is representative of the experience of more than a few in-use vehicles. Notwithstanding this, the Ford program does suggest that, under conditions other than those used in the Ethyl program, vehicles show substantially higher MMT-induced HC emissions increases than those found by Ethyl. Because of the relationship described earlier between high driving speeds, engine temperatures and manganese deposition, EPA believes that the difference in driving cycles between the Ethyl and Ford test programs is the likely reason for at least some of the differences in test results. The Agency believes that the AMA cycle that Ethyl used reflects a mileage accumulation driving cycle that approaches the average; however, available data on driving cycle is inadequate to reliably establish the distribution of driving cycles around the average cycle.[53] In fact, the Agency is

---

[53] EPA found four data sets concerning in-use driving cycles. Two of them do not provide any information on the distribution of driving cycles around the average. A third set is based on diaries kept by vehicle owners and as such is not as reliable as data based on independently monitored vehicles. The third data set also does not reflect actual speed travelled. The fourth set is based on well-monitored (by instruments inserted in

currently investigating the driving cycles to which in-use vehicles are subjected as part of its implementation of section 206 of the Act. This data will not be available until the spring of 1992. Since the Agency has only 180 days to consider a waiver application, it was not possible to determine, with reasonable confidence, how many vehicles are subjected to driving cycles "more severe" (i.e., higher speed) than the average or how much more severely those cars are driven. Even if the distribution of driving cycles around the average were known, the Agency does not have enough information to determine how the HC emissions increases seen in the Ethyl program would be affected by driving cycles more severe than the AMA but less severe than Ford's. The only data points it has on the effect of driving cycle on MMT-induced HC increases are those from the Ethyl and Ford test programs. Until additional testing is done using driving cycles intermediate in severity to the Ethyl and Ford cycles, EPA cannot map the shape of the curve defining the relationship between driving cycle and MMT HC effect -- it could be linear or there could be a "threshold" point after which MMT's effect does not worsen. Thus, despite the fact that Ford's driving cycle is not representative of in-use driving, its use appears to have confirmed that MMT's effect on HC

---

the vehicle) vehicles but is limited to a relatively small number of vehicles in one area of the country over a relatively short period and thus is not broad-based enough to permit generalizing to the rest of the country. Furthermore, it has been suggested that the use of instrument monitored vehicles to study driving habits may skew the results since an operator may drive differently if the operator knows his driving is being constantly monitored. (See "Data from Driving Cycle Studies", EPA submission to Docket A-91-46.)

increases will worsen with more severe driving. Until more is known about in-use vehicles' driving cycles and the effects of those cycles on MMT-induced HC increases, EPA cannot conclude that MMT will not cause or contribute to emissions increases based on the Ethyl data alone. Furthermore, although the Toyota test program design is open to some criticism[54], the limited data is suggestive of a larger MMT-induced increase in HC emissions especially in light of its similarity to the Ford data.

Ethyl indicated that the high-speed testing which it had performed indicates that no catalyst problems should occur at driving cycles outside of "the average". Catalyst durability tests performed by Ethyl on most of its 48-vehicle fleet as well as on other vehicles which were driven using high-speed or high stress driving cycles were evaluated by EPA. As mentioned previously, these involved back-pressure tests on the 48-vehicle fleet after 75,000 miles, on two Crown Victorias driven at higher speeds for a total of 45,000 miles, and on two Corvettes driven for 25,000 miles at very high speeds. The 48-vehicle fleet data appear to indicate that at higher mileage (75,000 miles) and for the driving

---

[54] For example, the use of the same vehicle as a control and an MMT vehicle by Toyota has been criticized as poor program design since any observed MMT-effect could be simply due to variation between the quality of components. (When a separate control and test vehicle is used, this variability can be taken into account.) Toyota believes that since the "control" portion of the test occurred after the vehicle had been exposed to MMT, if anything this would minimize the differences in HC emissions between the MMT and control vehicle.

The addition of slightly higher contamination levels of lead (in the gasoline) and phosphorus (in the motor oil) by Toyota also may have led to increased catalyst degradation.

conditions under which Ethyl's 48-vehicle fleet was tested (the AMA driving cycle), little or no plugging occurred. The tests on the two Crown Victorias suggest that little plugging occurred up to 45,000 miles at speed despite the fact that the cars were driven more severely than the AMA. The tests on the two Corvettes suggested that, at low mileage (25,000 miles) and very high speeds, some small amount of increased plugging occurred.

EPA does not believe that Ethyl's back-pressure test data establishes that MMT's emissions effect is not worsened by more severe driving. The back-pressure data for vehicles that were subjected to high-speed driving are limited to only four vehicles from two model groups and over a mileage range which is less than the vehicles' useful life. Hence, although the 75,000-mile fleet back-pressure testing indicates little plugging, the data on the potential for high speed driving to increase plugging is too limited to come to a statistically sound conclusion. Furthermore, it is not apparent that plugging of the catalyst is the only mechanism which may result in increased HC emissions or catalyst degradation. In fact, automakers and catalyst manufacturers indicate that the mere presence of manganese on the surface of the catalyst may reduce the number of sites at which emissions may be catalyzed. Hence, back-pressure data do not necessarily prove that substantial degradation has not taken place.

Likewise, the catalyst efficiency data was collected on vehicles which had operated at speeds associated with the AMA driving cycle, and thus no conclusions can be reached regarding

catalyst efficiency at higher speed cycles for a representative number of vehicles over the appropriate "useful life" of the vehicles.

As mentioned previously, Environment Canada, in its comments, stated that it had little data on MMT effects on Canadian vehicles, but that it appeared that only a relatively small number of catalysts installed on Canadian vehicles had been adversely affected by plugging. It indicated, however, that difference between the Canadian and United States vehicle emission control programs made it less likely that any catalyst plugging would be discerned in Canada than might be the case in the United States. In light of these comments, EPA did not find Canada's experience instructive.

The Agency believes that without additional investigation as to what parameters alter the effect of MMT on emissions, it is impossible to say precisely why Ford (or Toyota) saw significantly greater emissions increases with MMT use than Ethyl saw. As noted earlier, EPA believes a likely candidate parameter to explain the differences between the Ford and Ethyl results is driving cycle. In the past, the Agency has said that in order to meet the section 211(f)(4) burden, it is reasonable for an applicant to choose a representative subset of the fleet to predict what effect the additive would have on the entire U.S. fleet. Hence, the Agency has always accepted data from test programs which "model" the fleet in support of waiver applications. Nevertheless, if an interested party were to present data that a potentially significant subset of

the fleet, not tested by the applicant, was especially susceptible to the negative effects of the additive, it would not be unreasonable for the Agency to require specific testing on representative models of that sub-fleet. Likewise, the Agency in the past has accepted emissions testing based on "average" driving cycles using "average" fuels for additive testing. In this case, however, Ford has presented reasonably reliable data that suggest that MMT may have a significantly different effect on a potentially significant subset of the fleet that operates outside of the "average" based upon factors other than model type (such as driving cycle). Further, Toyota has presented data that, although problematic, is notably similar to the Ford data. In the face of such data, the Agency may reasonably conclude that the waiver applicant has not met its burden of establishing that its additive will not cause or contribute to vehicles' noncompliance with emissions standards and that testing under certain "non-average" conditions is required.

Ethyl has asserted in its application that upon presentation of a prima facie case that use of HiTEC 3000 will not cause or contribute to the failure of emission control devices to meet applicable standards, the burden of proof then shifts to others trying to refute or critique that case. EPA does not agree. The statute states that the waiver applicant must establish that the additive does not cause or contribute to any vehicle's failure to meet the emission standards with respect to which it has been certified. Nowhere does it provide that the burden of proof shifts

upon an applicant making a prima facie case. EPA believes the burden stays with the applicant, which has the financial interest in obtaining the waiver. It would not be reasonable to require other entities without a financial interest in the waiver to expend the kind of resources a waiver applicant must sometimes expend to develop data adequate for use in EPA's statistical tests. It is enough that other interested entities provide reasonably reliable data that raises a substantial doubt that the waiver applicant has failed to make the required showing. The burden is then on the waiver applicant to address the doubt raised by the additional data.

Ethyl also claims that EPA must decide issues of fact in waiver decisions based on the preponderance of the evidence in the record. Section 211(f)(4), however, does not specify this standard of proof. Rather, it provides that the waiver applicant must "establish" that its fuel will not cause or contribute to vehicle emission noncompliance. Where, as here, there is insufficient data to a make a determination one way or another on important factual issues, Ethyl may not use a preponderance of evidence test to bootstrap the requisite showing. Until data exist that are adequate to make the relevant determinations with reasonable confidence, Ethyl has not established that MMT will not cause or contribute to emissions noncompliance.

Beyond that, the conclusions to which Ethyl's evidence point do not address the conclusions that result from the Ford evidence. As stated above, the results of the Ford data indicate that factors

other than those taken into account in Ethyl's test program may significantly and adversely influence the emissions caused by the addition of HiTEC 3000 to unleaded gasoline.

Ethyl's test data indicate that, when EPA's traditional statistical tests are applied, the 0.018 gpm increase in HC emissions would not cause or contribute to vehicles' failure to meet emissions standards. On this basis, Ethyl claimed that it had made its statutorily required showing. However, Ethyl's data do not address the fact that a potentially significant subset of the fleet may be susceptible to the negative effects of HiTEC 3000. Although the Ford data does not unequivocally demonstrate that HiTEC 3000 does cause or contribute to the failure of vehicles to meet standards, the Ford data show that some factor or combination of factors can cause emissions increases far larger than those observed by Ethyl. Moreover, although it can be hypothesized what these factor(s) may be, the Agency cannot say with any degree of certainty <u>why</u> Ford's vehicles demonstrated such a different MMT-induced emissions increase. Finally, the uncertainty posed by the possibility of increases higher than those seen by Ethyl is complicated by the fact that, beginning in model year 1994, vehicles must meet new more stringent hydrocarbon emission standards over a longer useful life. (A description of these new more stringent standards can be found in Appendix 2.) Thus, any MMT-induced increase in emissions over and above those seen by the Ethyl program would be even more significant in contributing to vehicles to fail standards. Until the factor which caused the

differences between the Ford and Ethyl test programs can be isolated and the effect that this parameter may have on MMT-induced emissions changes can be investigated, whether MMT will cause or contribute to vehicles failing to meet emissions standards cannot be determined. Thus, the Agency must deny the application.

B. Other Issues

As mentioned previously in this decision, many commenters expressed concerns about the possible adverse health effects of an increase in airborne manganese. The bulk of these concerns dealt primarily with first, the known severe neurotoxic effect of high-level exposure to manganese through inhalation, and, second, with the profound lack of data regarding the chronic effects of low-level inhalation exposure to manganese in humans. It was repeatedly pointed out by commenters that neurotoxic damage could occur prior to the onset of overt symptoms.

Ethyl submitted comments regarding manganese emissions. It is Ethyl's position that the manganese emissions resulting from the use of MMT in unleaded gasoline would be so small as to not materially affect human exposure to airborne manganese. In support of this view, Ethyl submitted analyses in its 1990 application (and subsequent comments) as well as further analyses and data on exposure modeling and monitoring in its 1991 application.

During EPA's consideration of the 1990 Ethyl submission, EPA's Office of Research and Development (ORD) conducted a manganese inhalation risk assessment based on the available data which found that because of "the considerable uncertainties and data gaps in

the available information...it is not possible ... to conclude definitively that the increased use of MMT as a fuel additive will (or will not) increase public health risk."[55] (ORD also investigated potential hazards associated with water contamination resulting from accidental spills or leakages of pure MMT and concluded that while spills or leaks would not pose a human health risk due to groundwater contamination, available data are insufficient to determine whether spills and leaks could affect exposure to benthic organisms.

In order to obtain assistance in describing information needed to improve its manganese health risk assessment (and also to improve its environmental hazard identification of issues associated with MMT itself), EPA, in conjunction with National Institute of Environmental Health Sciences, conducted a Manganese/MMT Conference on March 12-15, 1991. The conference allowed the Agency to solicit scientific information and judgments from invited extramural scientists reflecting a wide range of scientific disciplines. Invited participants included representatives of Ethyl Corporation, the Environmental Defense Fund, the Centers for Disease Control, the U.S. Food and Drug Administration and Environment Canada. A summary of the workshop discussion was provided to each participant. The information obtained in that meeting was also used by ORD to prepare a prioritized list of needed research for improving its manganese

---

[55] See "Comments on the Use of Methylcyclopentadienyl Manganese Tricarbonyl in Unleaded Gasoline", Docket A-90-16.

inhalation risk assessment. EPA currently is evaluating ORD's recommendations. Because the data needed to make a reasonable judgment as to MMT's manganese health effects is unavailable, this issue remains unresolved.

In addition, the Agency is concerned about possible additional atmospheric loading associated with widespread use of MMT in light of the serious ozone nonattainment problem in the U.S. As mentioned earlier, in 1990 there were still 98 areas, containing 135 million people, that violated the ambient ozone standard. The magnitude of the hydrocarbon increase associated with the use of MMT is an environment concern because hydrocarbons plays a key role in the formation of ozone or urban smog and in secondary formation of particulate matter.

Using the HC increase shown by the Ethyl fleet (0.018 gpm) for 1981 and later model vehicles and a HC increase of 0.09 for pre-1981 model vehicles,[56] EPA estimates, prior to 1995[57] that with an

---

[56] This 0.09 gpm increase is based on the Coordinating Research Council study of MMT (Benson, J.D., and R.J. Campion and L.J. Painter, "Results of Coordinating Research Council MMT Field Test Program", SAE Paper 790706, June 11-15, 1979, p.6.). Using Mobile 4.1 data for 1992, almost 14 percent of the gasoline vehicle miles traveled (VMT) were pre-1981 model vehicles.

[57] In 1995, section 211(k) of the Act requires that reformulated gasoline be sold in at least the nine worst ozone nonattainment areas in the country. This provision provides for a ban on fuels containing heavy metals like Mn unless waived. It is premature to predict whether such a waiver would be granted and the extent to which, if granted, refiners might need to compensate in other ways for any HC increases due to MMT use.

84 percent market penetration for HiTEC 3000,[58] HC increases for the entire nation could be approximately 48,000 tons per year.[59] In comparison, the estimated HC reductions associated with full implementation of the Tier I standards for passenger cars and light-duty trucks prescribed under the new Clean Air Act is expected to be 193,600 tpy when fully implemented in the year 2010.[60]

Ethyl argues that the MMT-induced HC increases observed in its test fleet are mitigated by other claimed benefits. First, "real world" HC emissions will be less since the replacement of aromatic octane enhancers by MMT will offset the HC increase and result in less reactive emissions. Second, MMT use will actually result in decreases in NOx, CO, benzene and formaldehyde emissions. Finally, refinery emissions will decrease and crude oil savings will be realized.

---

[58] Sobotka, Inc., an EPA contractor investigated the likely market penetration which would be achieved by HiTEC 3000 nationwide. For an all-conventional gasoline scenario (i.e., prior to the introduction of reformulated gasoline), Sobotka estimated that 84% of U.S. gasoline would likely utilize HiTEC 3000. (See Memo from Sobotka, Inc., dated January 7, 1992 in Docket A-91-46.)

[59] This estimate is based on a yearly U.S. gasoline consumption of 110 billion gallons (DOE/EIA Petroleum Supply Monthly, November 1991, Table 5, p.37) and an average nationwide fuel economy of 19.1 miles per gallon (USEPA Mobile4.1 Motor Fuel Consumption Model, 1991). California, which represents about 12 percent of U.S. consumption was excluded from this nationwide figure because it has a statewide statutory prohibition of manganese-containing gasoline additives.

[60] "Ozone Nonattainment Analysis Clean Air Amendments of 1990" (September, 1991), a draft report prepared for EPA by E. H. Pechan & Associates, Inc., pp. 7 & 9. The tonnage figures were reduced by 12% to remove California tonnage and make the figures comparable to MMT increases.

EPA is still evaluating the validity of Ethyl's arguments and their impact on total atmospheric loading and, as such the Agency has chosen not to base its decision, in whole or part, on this issue.

VII. Findings and Conclusions

As discussed in section VI above, data submitted to the Agency by Ford indicate that the amount of HC increase resulting from the use of HiTEC 3000 in gasoline may significantly depend upon factors other than those considered by Ethyl. The Agency cannot determine what other factors resulted in the large HC increases observed by Ford. Therefore, until the factor or factors which resulted in these differences can be isolated and the effect that these parameters may have on MMT-induced emissions changes can be investigated, the Agency must conclude that the record does not adequately show that vehicles will not fail standards as a result of using MMT-containing fuel under diverse operating conditions. Therefore the applicant has not met the statutory burden required by the Act and the request for a waiver is hereby denied.

Finally, EPA acknowledges the broad scope and generally high quality of the testing program carried out by Ethyl. However, the core of the Agency's dilemma, and the root of its decision to deny the waiver request by Ethyl, is the Agency's inability to reconcile the results of the vehicle testing done by Ford and Ethyl. The Agency believes that is may be possible to design a test program aimed at reconciling these differences. We would be willing to work with Ethyl and representatives of motor vehicle manufacturers

to explore means of promptly developing such additional data.

EPA has determined that this action does not meet any of the criteria for classification as a major rule under Executive Order 12291. Therefore, no regulatory impact analysis is required. This action is not a "rule" as defined in the Regulatory Flexibility Act, 5 U.S.C. 601 et seq., because EPA has not published, and is not required to publish, a Notice of Proposed Rulemaking under the Administrative Procedure Act, 5 U.S.C. 553(b), or any other law. Therefore, EPA has not prepared a supporting

regulatory flexibility analysis addressing the impact of this action on small entities.

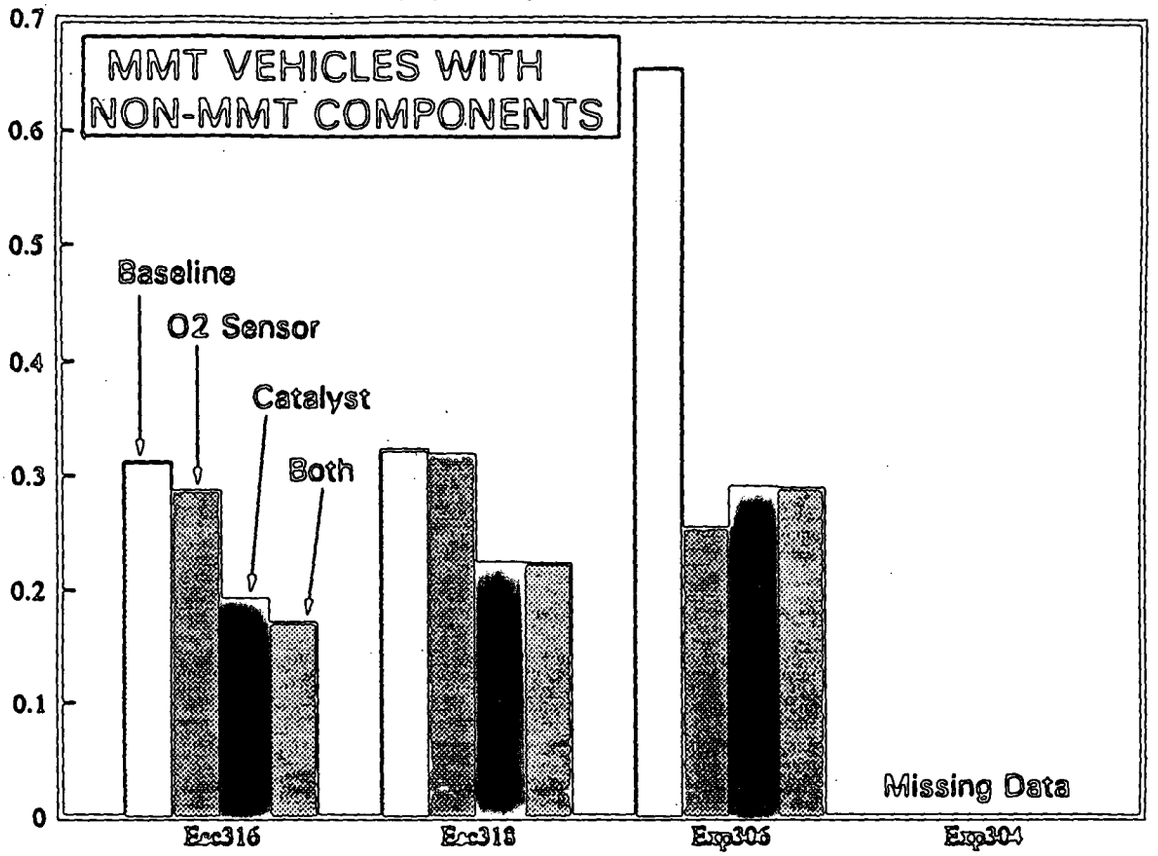
This is a final Agency action of national applicability. Jurisdiction to review this action lies exclusively in the U.S. Court of Appeals for the District of Columbia Circuit. Under section 307(b)(1) of the Act, judicial review of this action is available only by the filing of a petition for review in the U.S. Court of Appeals for the District of Columbia Circuit within 60 days of [INSERT DATE OF PUBLICATION OF THIS NOTICE]. Under section 307(b)(2) of the Act, today's action may not be challenged later in a separate judicial proceeding brought by the Agency to enforce the statutory prohibitions.

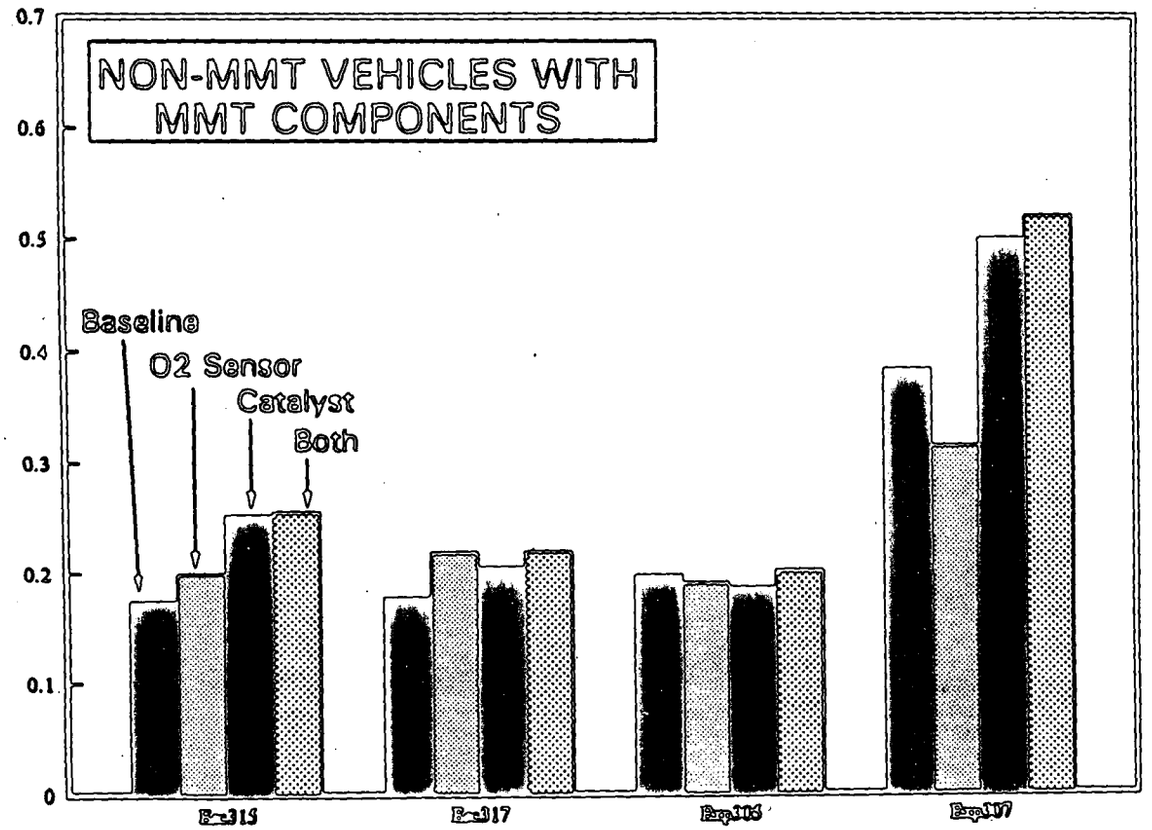
William K. Reilly Date Jan 9, 1992

Administrator

Appendix 1: FORD EMISSIONS DATA: COMPONENT CHANGES

Tailpipe Hydrocarbons





Appendix 2. CURRENT AND FUTURE HYDROCARBON STANDARDS

Vehicle Type	Current HC Standard	Future NMHC[1] Standard[2]
LDV[3] 5 year/50K	0.41 gpm	0.25
LDT 11 year/120K	0.8 gpm	---
LDT 5 year/50K	---	0.25
LDV/LDT 10year/100K	___	0.31
LDT > 3750lbs (5/50K)	---	0.32
LDT > 3750lbs (10/100K)	---	0.40

[1]NMHC refers to non-methane hydrocarbon. The new standard is based upon a subset of the total hydrocarbons emitted. Therefore, direct comparison with the current standard is not appropriate. The new standard, however, is more stringent than the old standard in consistent hydrocarbon species.

[2]Future standards are phased in over a three year period during which 40 percent of a manufacturer's sales volumes must meet these standards for model year 1994, 80 percent for 1995, and 100 percent after 1995.

[3]LDV refers to light duty vehicle. LDT refers to light duty truck.